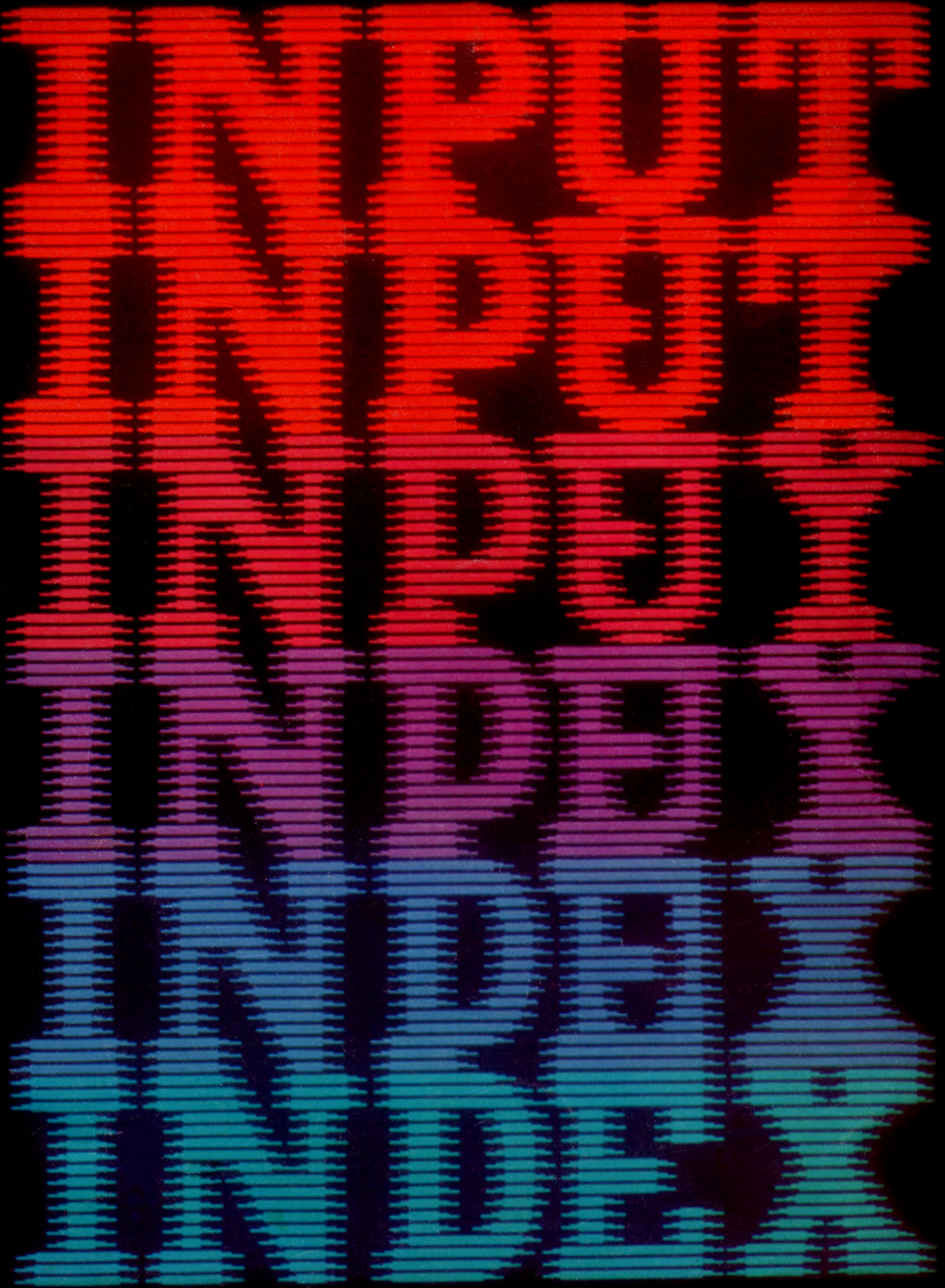
A MARSHALL CAVENDISH 52 COMPUTER COURSE IN WEEKLY PARTS



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INPUT

Vol 4 No 52

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To all our readers,

Well, that's it! With this, the complete index to the Input Programming Course, your collection is complete.

It is impossible to predict what the future will bring, but one thing that does seem certain is that computers will play a bigger and bigger part in everyone's life. We hope that you have enjoyed your start in programming and that you have had as much fun reading *INPUT* and trying the programs as we have done in writing it for you.

Whether you have typed in all the programs yet or not, you will still want to keep *INPUT* as a source of reference material for the future. If you haven't bound your copies yet, and want to keep them in tip-top condition, the inside back cover gives details of a last-chance offer to obtain the special *INPUT* binders.

Best wishes for the future in computing.

Andrew Kemp

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INPUT IS SPECIALLY DESIGNED FOR:

The SINCLAIR ZX SPECTRUM (16K and 48K), COMMODORE 64, ACORN ELECTRON and BBC B, and the DRAGON 32.

In addition, many of the programs and explanations are also suitable for the SINCLAIR ZX81, COMMODORE VIC 20, and TANDY COLOUR COMPUTER in 32K with extended BASIC. Programs and text which are specifically for particular machines are indicated by the following symbols:

SPECTRUM
COMMODORE 64
ACORN ELECTRON and BBC B
DRAGON 32
ZX81
VIC 20
TANDY TRS80 COLOUR COMPUTER

HOW TO USE THE INDEX

This index contains full details of all the articles and programs appearing in *INPUT*, Parts 1 to 51. To help you to find a particular reference as easily as possible, this information is arranged in two ways, in separate lists.

The first list is on pages 1622 to 1627. Here, you'll find a full table of all the articles arranged in the sections under which they appear in *INPUT*. So all the Games Programs,for example, are listed together. In each section, the article's title is given, followed by a short description of what it contains. So whether you can remember the title of the article, or just what it waş about, this quick-reference guide should find it for you with the minimum of fuss.

If you are looking for a more specific reference, rather than a whole article, the second index listing on pages 1628 to 1649 is the place to check. This is arranged alphabetically, like the mini-indexes which appear in each issue of *INPUT*. All the main topics are listed separately, and you'll also find references to each of the articles and programs.

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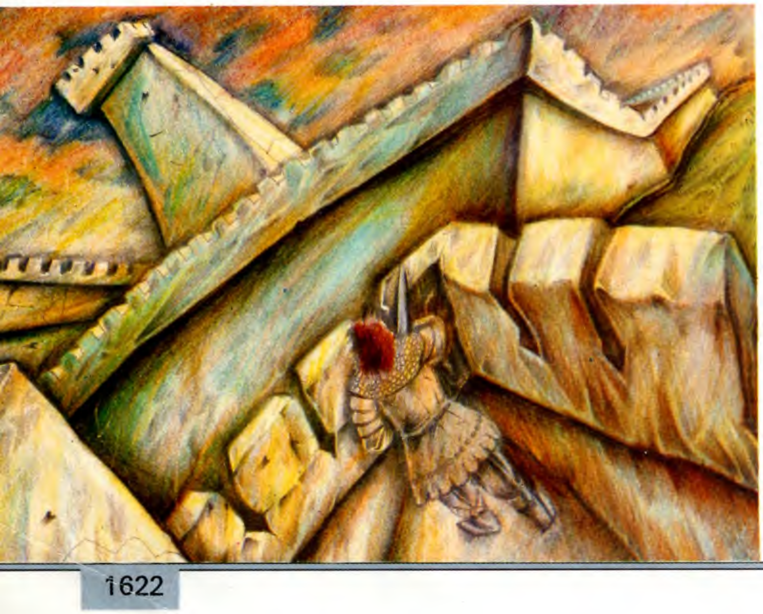

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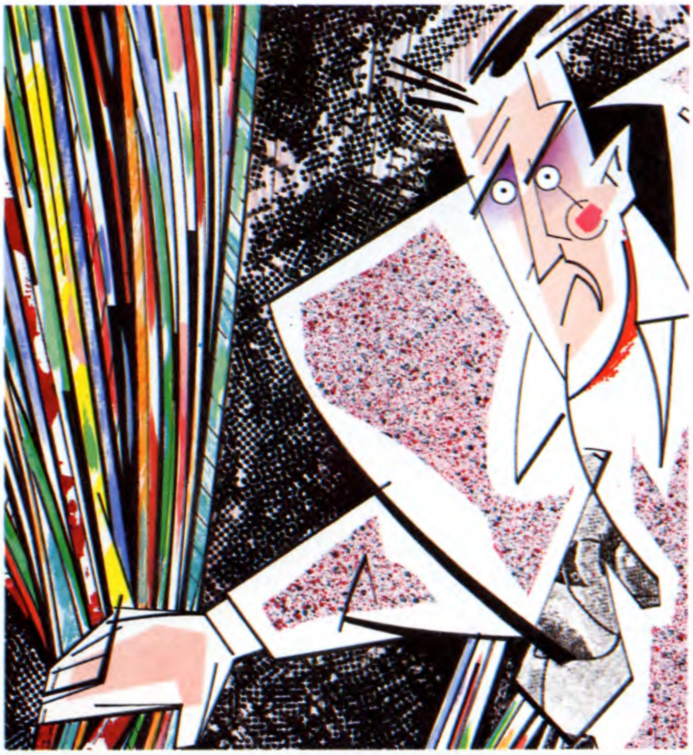

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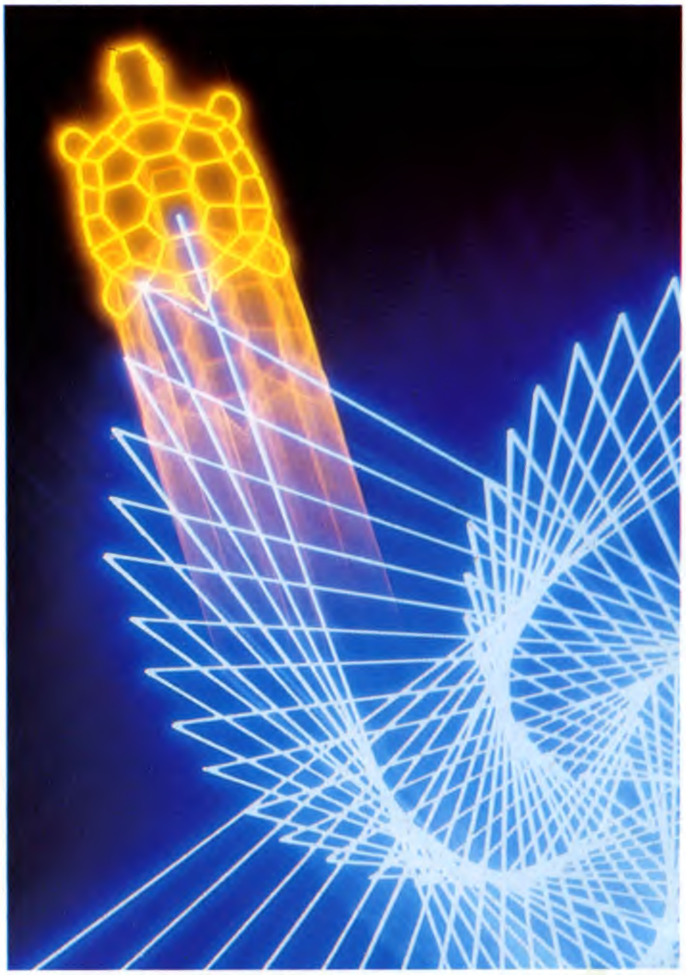

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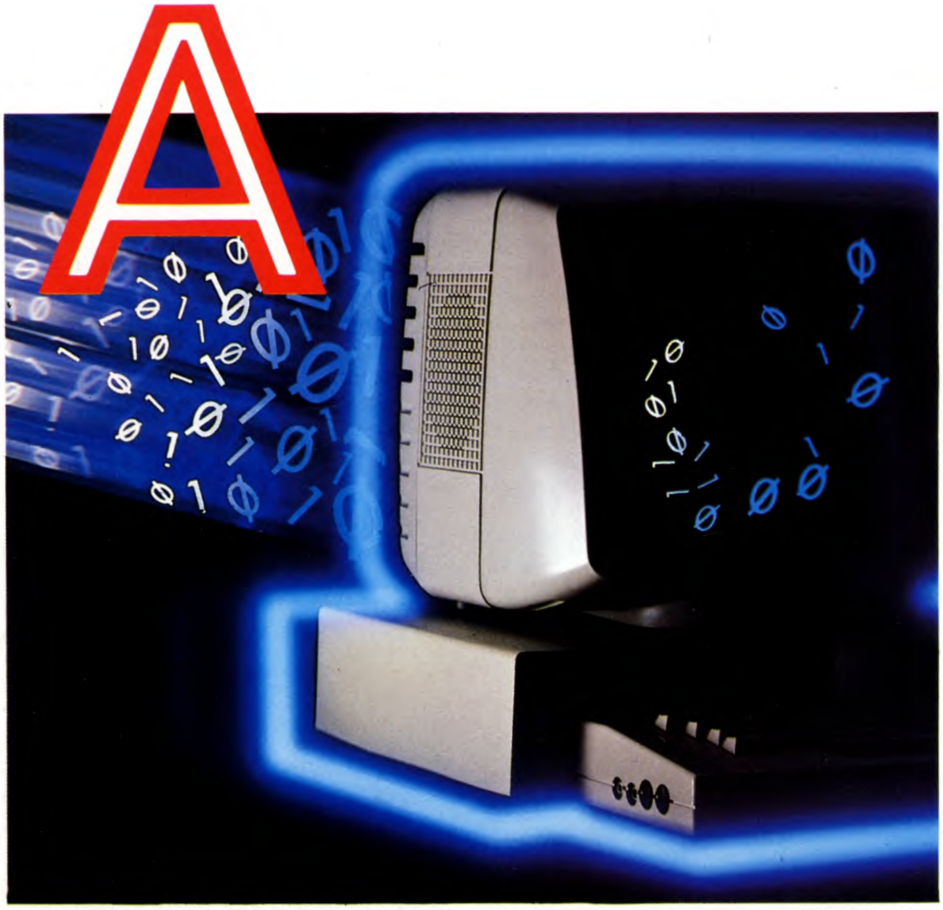

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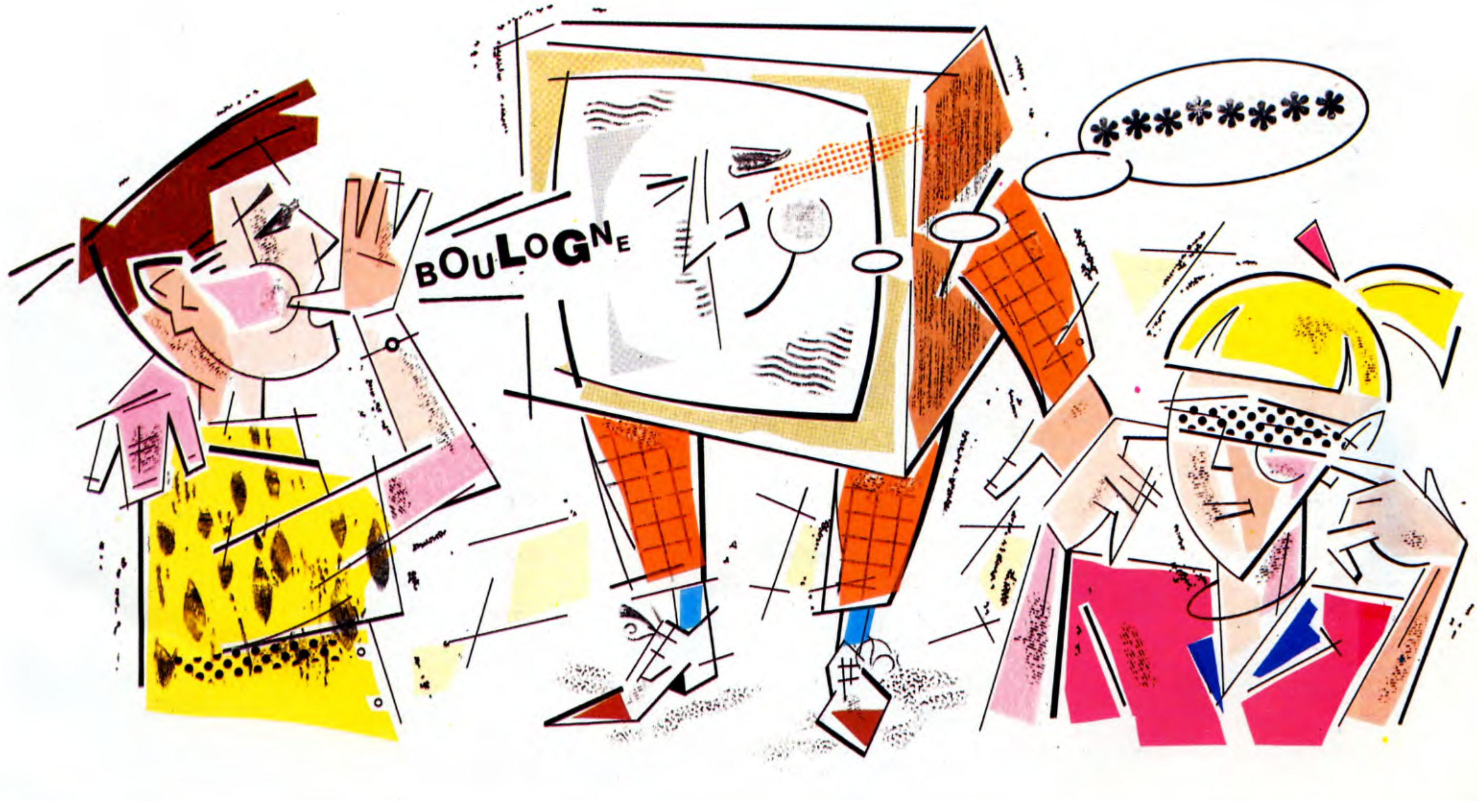

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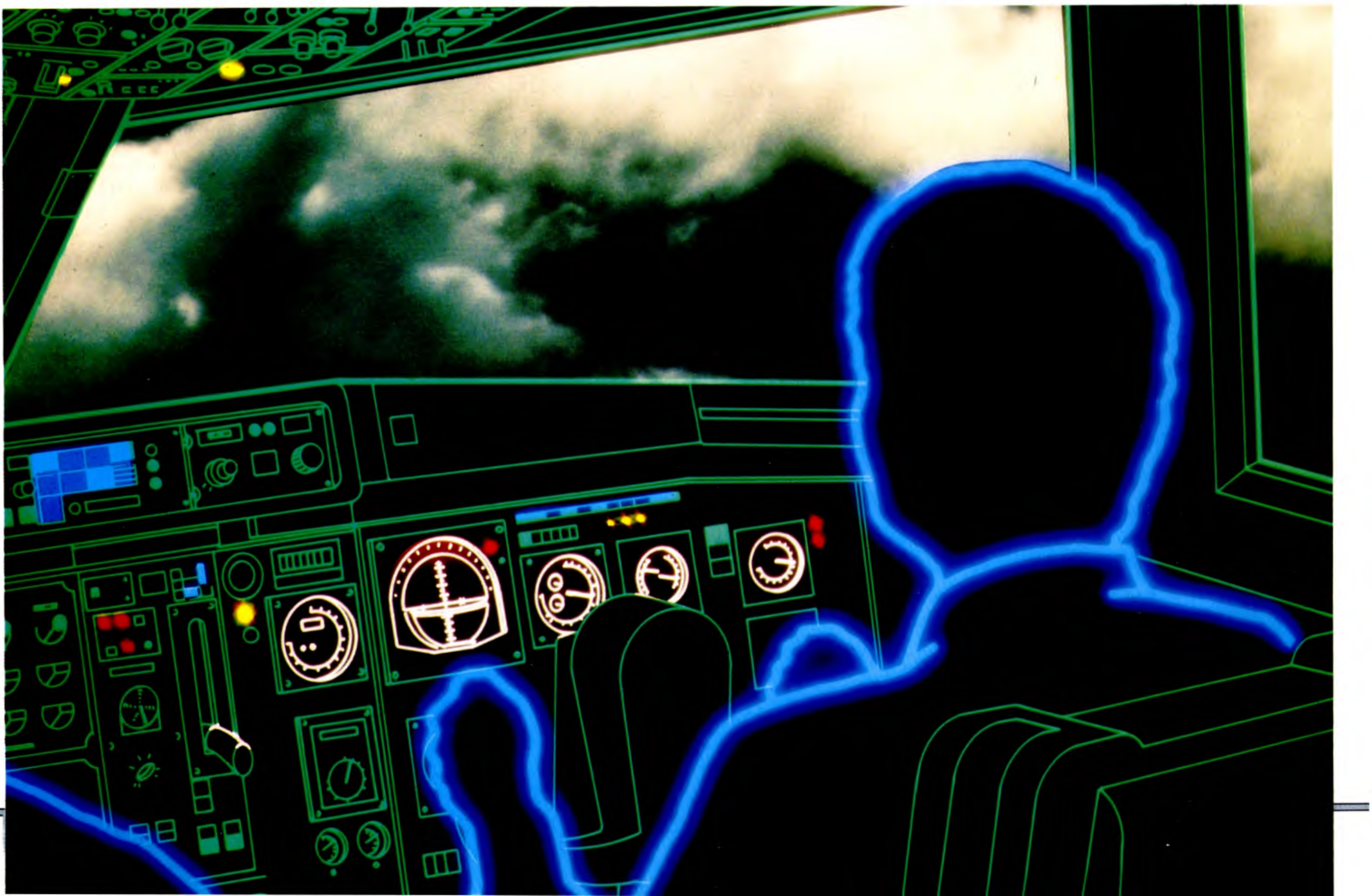

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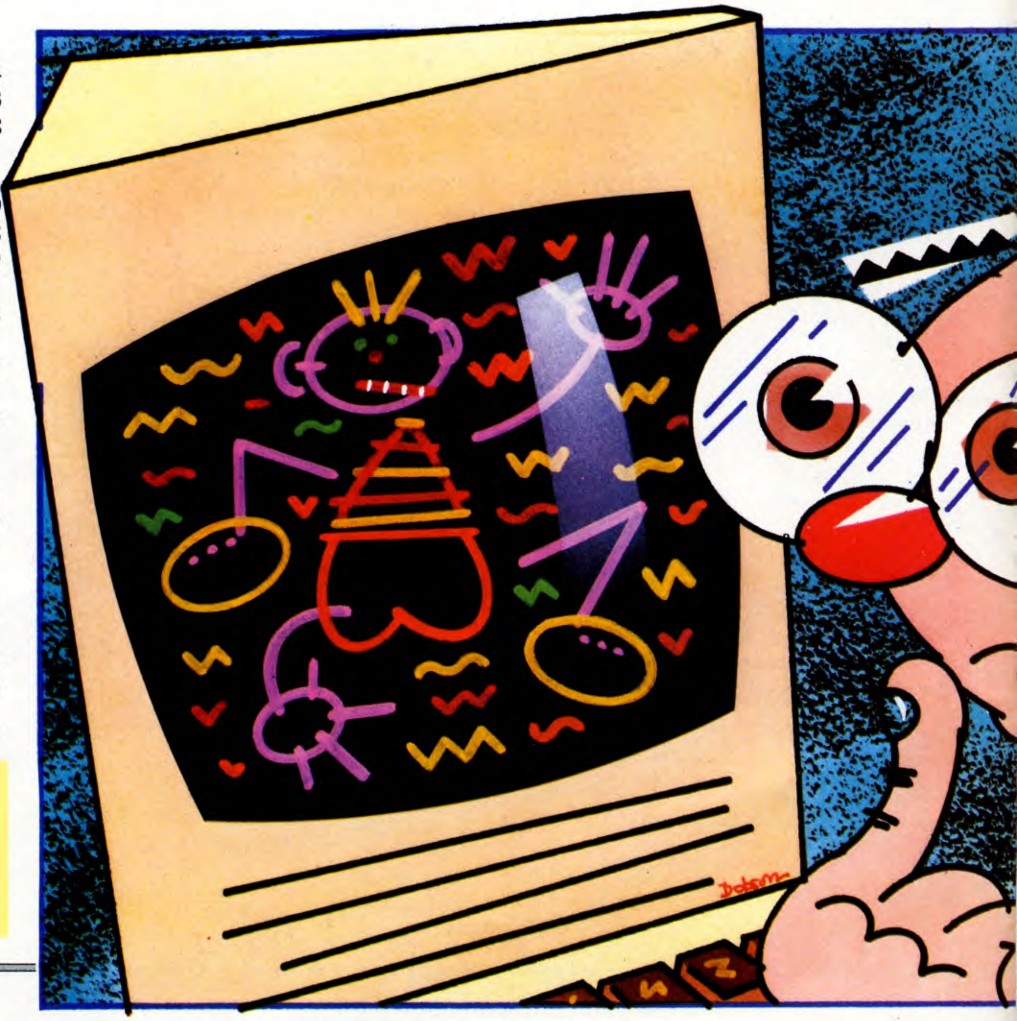

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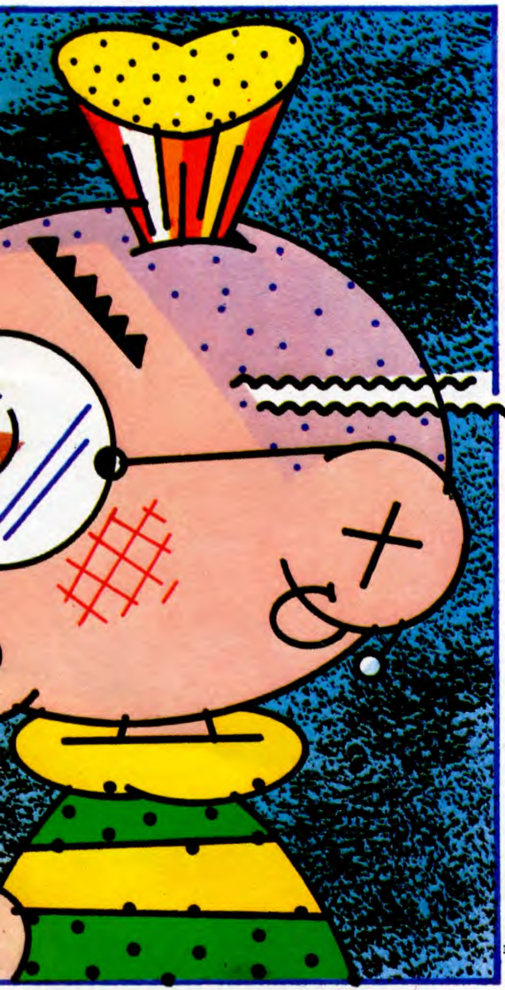

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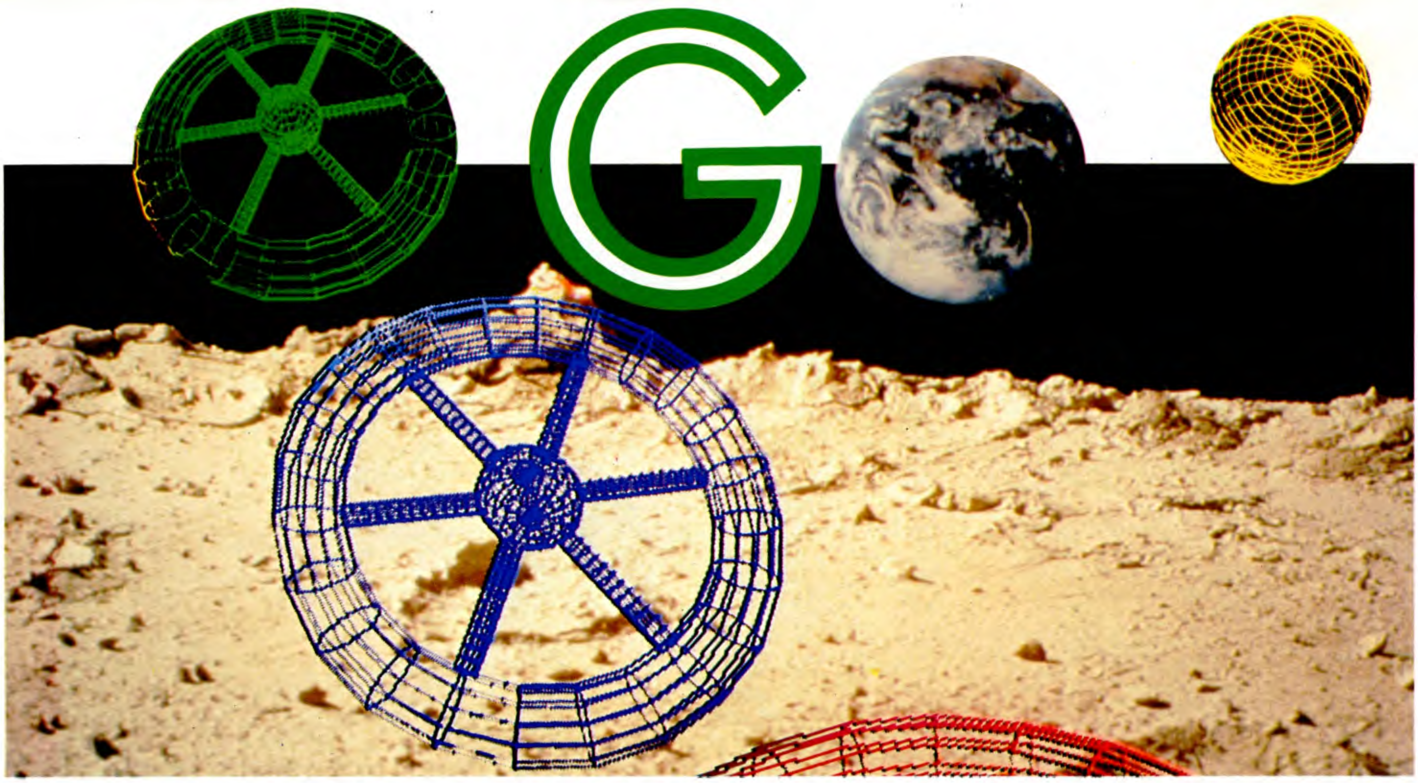

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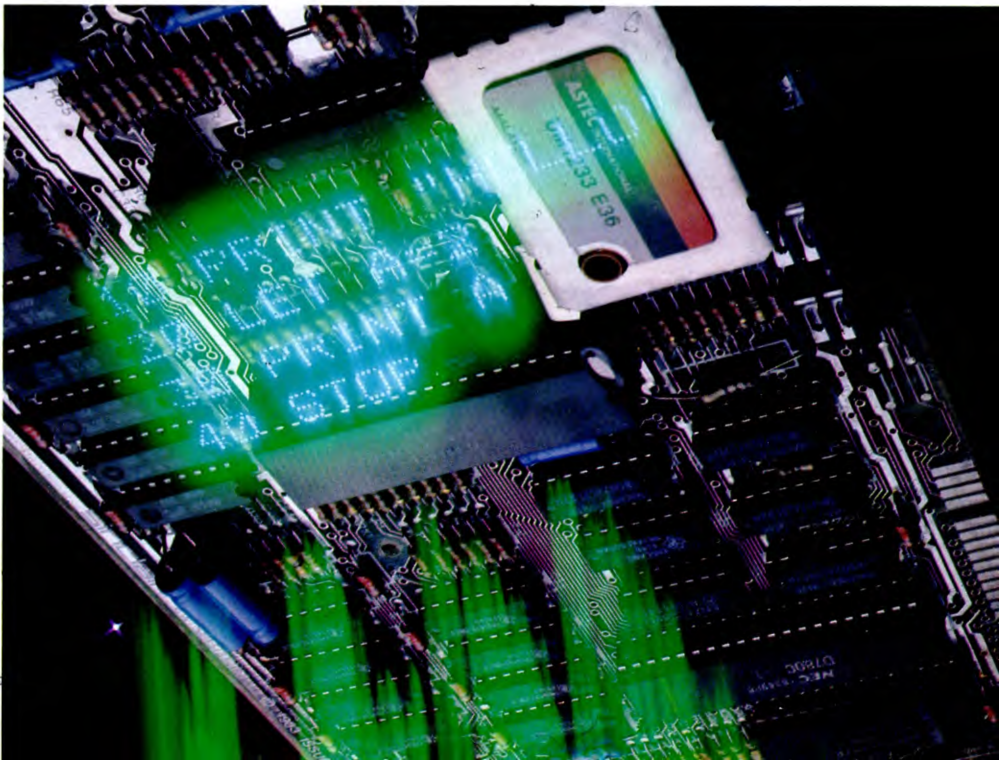

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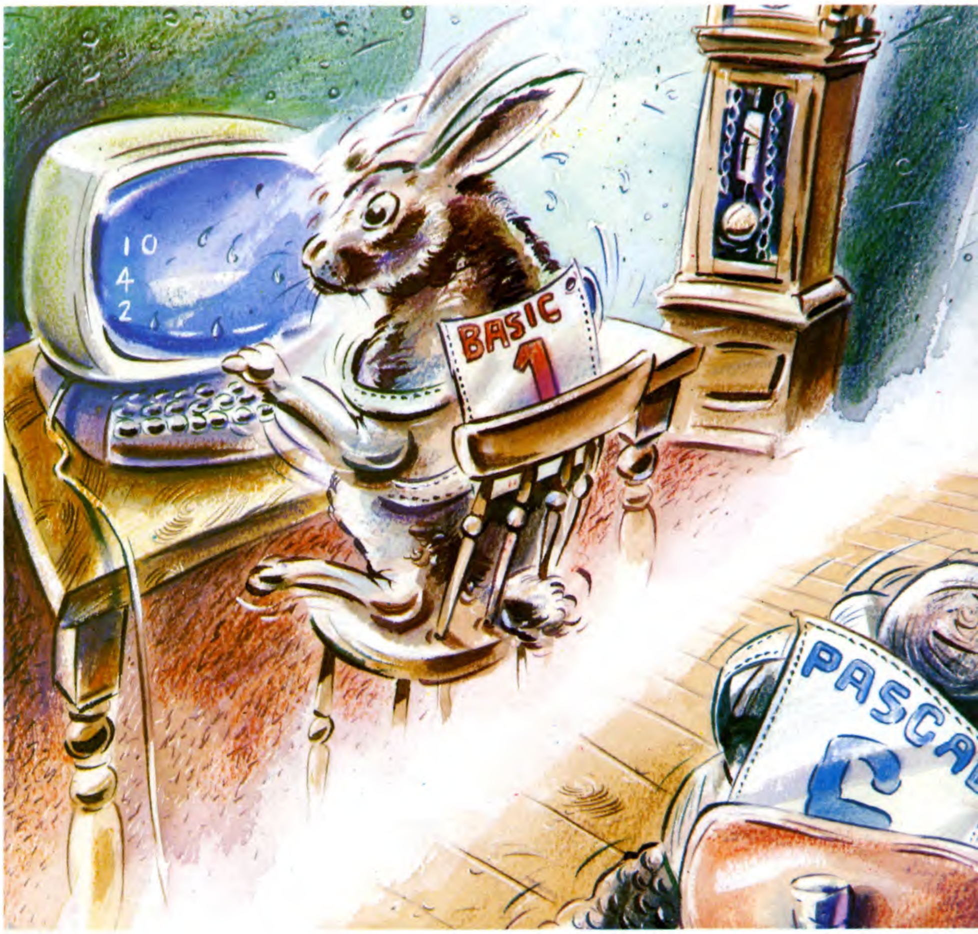

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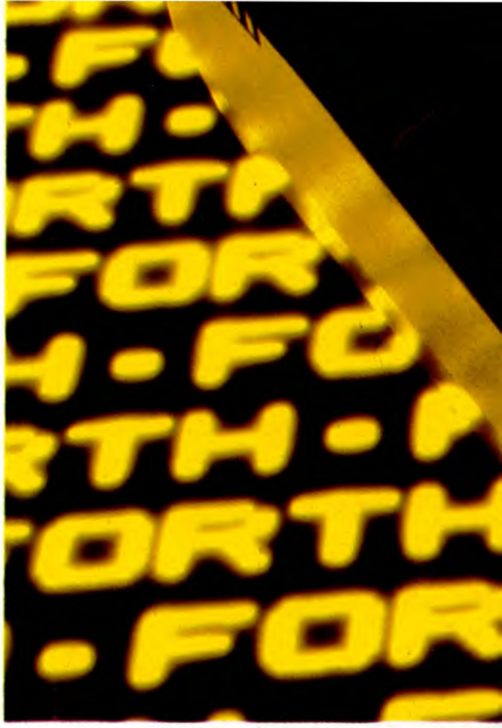

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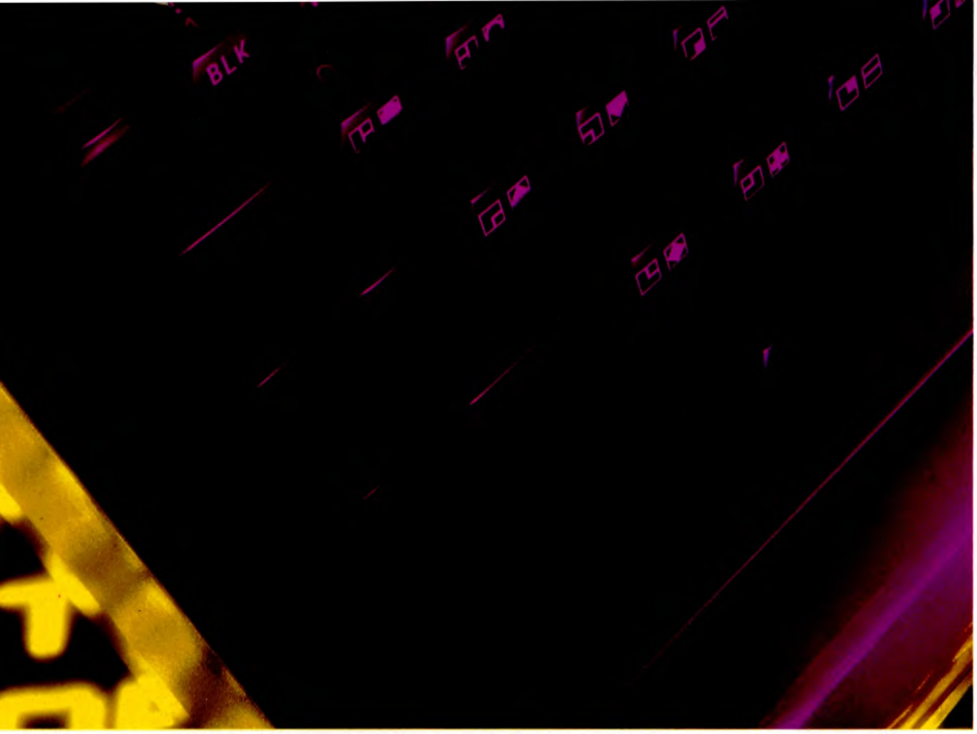

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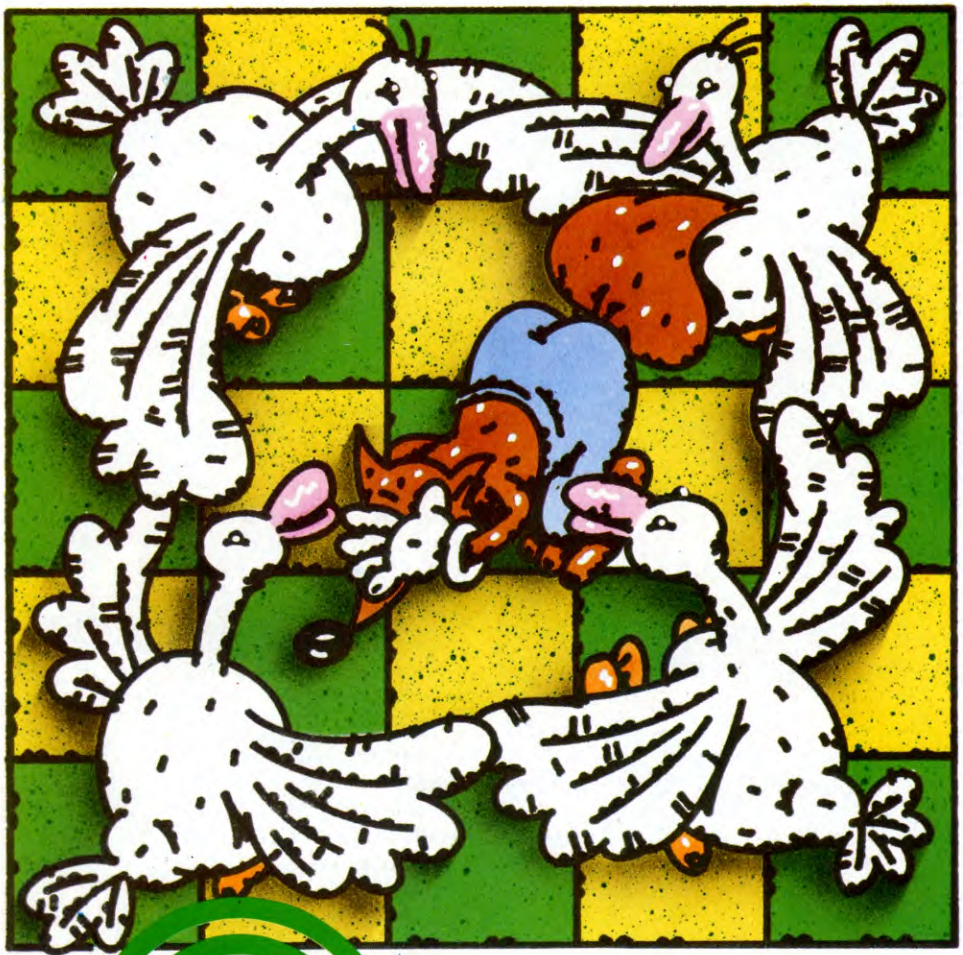

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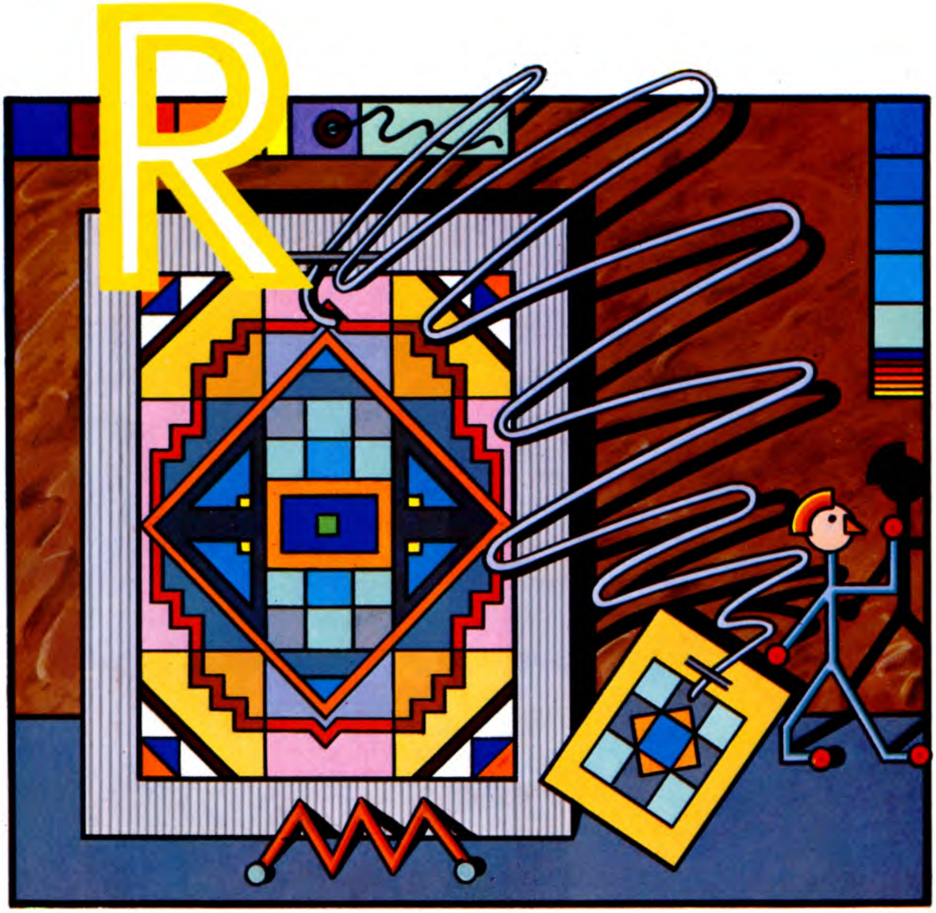

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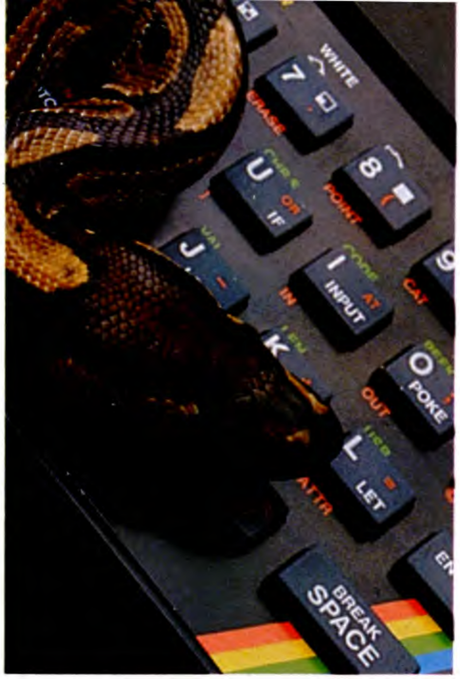

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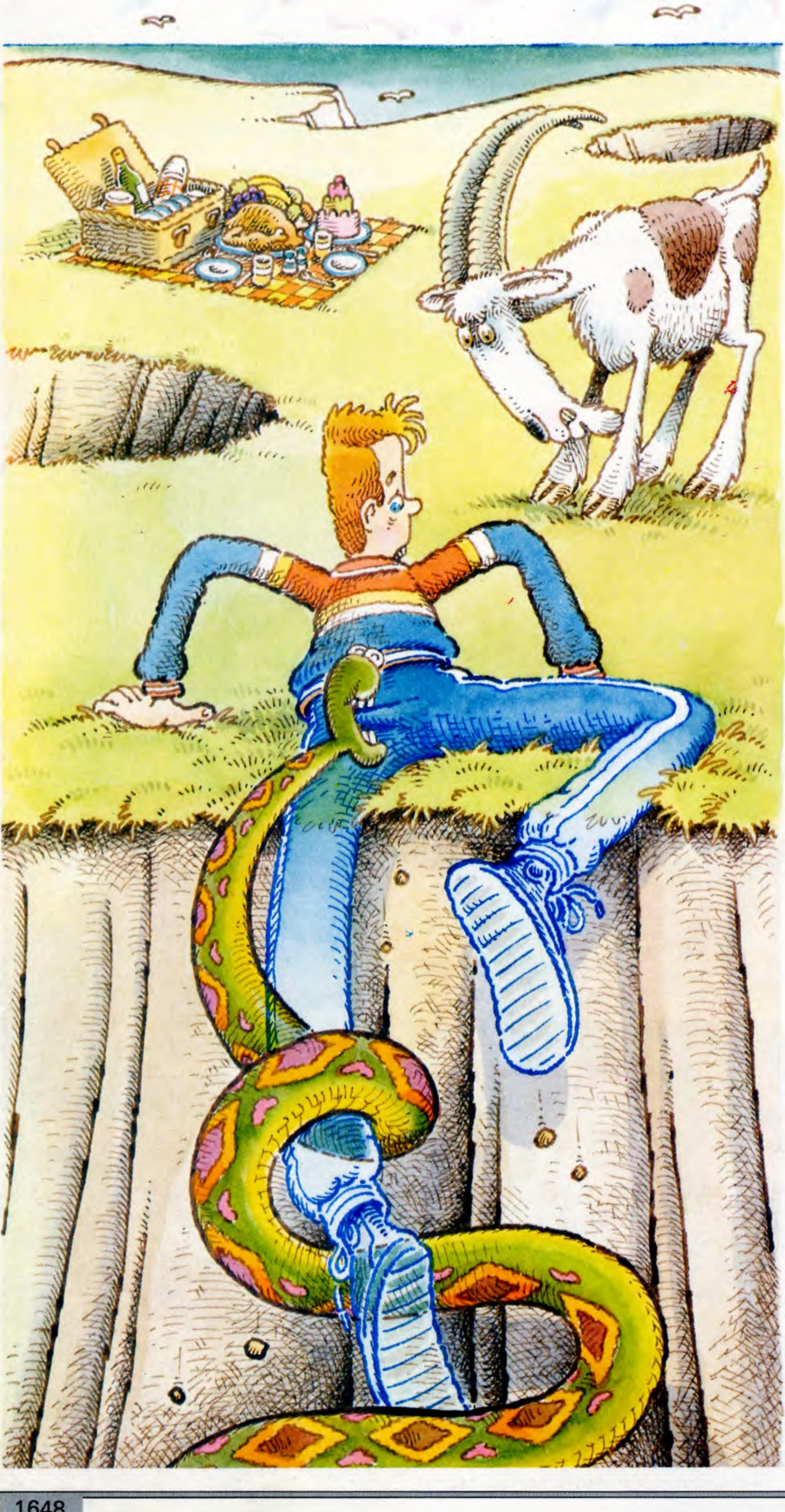

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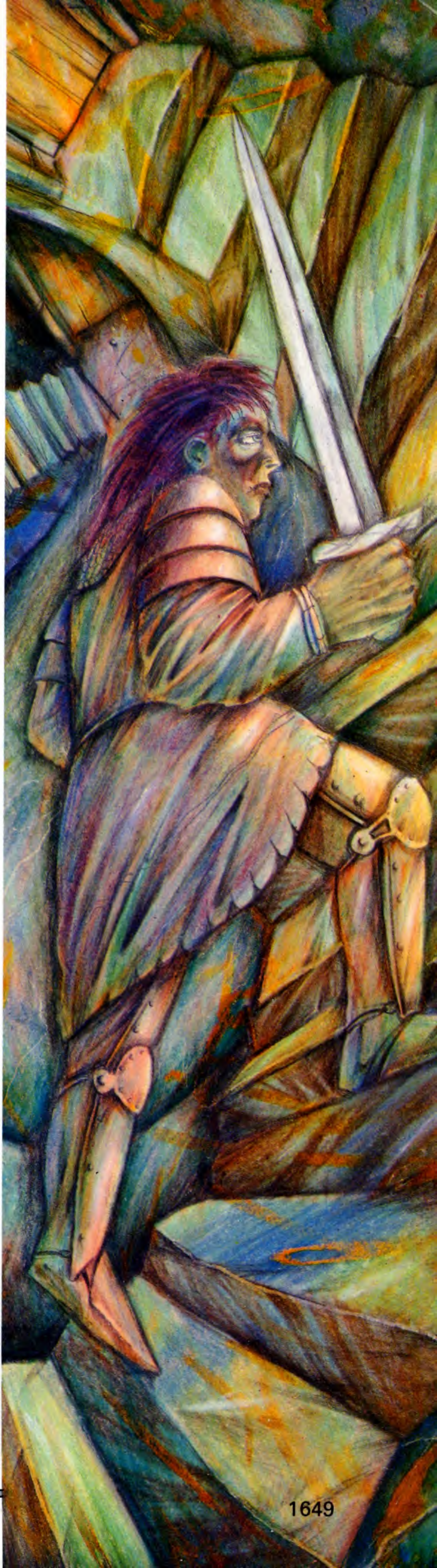

The purpose of INPUT is to teach people to program. Both known and unknown errors ('bugs') do indeed occur in INPUT, as in all other computer programs; we hope the more detailed explanations of programs given in INPUT have made it easier for you. If you are to learn to program remember that professional programmers spend 70 per cent of their time finding and removing bugs.

This is a short course in how to find and kill bugs, though the last section is devoted to advice for beginners and frustration-reducing tips. INPUT itself deals with bugs in an article in Issue 11. Bugs that have to be dealt with from INPUT include both your typing errors and genuine program errors; if you ever want to write programs seriously you will have to learn how to cure bugs without the aid of a guaranteed-correct script of the program. If your hardware can produce it, always print a listing of the program (so that you can see more than the small-screen window on the program), as the first step in debugging it. You will need a printer to write programs to a commercial standard (though a ZX-printer will do as you will be the only person who reads the listings).

Proofreading listings. As we shall see, this is not always the best way of finding bugs, but if done at all it should be done properly. It needs two people (a) because they can keep their place in two listings at once, and (b) because everybody has 'blind spots' and another person will see things differently from you.

Bug-hunting proper: There are at least two different styles, which can be named the 'Private Eye' and the other the 'Interpol' approach. Also given will be some desperation 'Military' methods which can be used as a last resort. The real Private Eye works by selecting and assembling his suspects in a small room and relentlessly spotlighting their defects.

How do you do this? After SAVEing the program you wish to debug, you should RUN it. (Never mind if you haven't got proper data for it; you will be lucky if it runs long enough to need any.) Almost immediately, with luck, it will fall over. Now you have your 'point of failure' – the equivalent of the Private Eye's small room and suspects.

PRIVATE EYE: LESSON 1

What to do with a point of failure. You probably have a computer-generated rude message on the screen. If you don't know what your manual says about this message look it up now before you lose it. (If you haven't got a manual with error messages explained, prepare yourself to program by either buying one or getting one out of your public library.) Jot down on paper any numbers in the message. Now list your version of the line that failed (just that line, listed on the screen). Can you see what is wrong with it? If you have master listing(s) compare it with them. If you can see what is wrong, put it right and score one dead bug. If the line reads something like:

```
8216 /256 SYNTAX ERROR
```

it was that calculation you forgot to put PRINT in front of. Erase it and check if there is a real line 8216 to take its place. Maybe you can't see it, eg:

```
230 IF TAND63=31 THEN T=T-64*INT
(T/64+5)-2)
```

so here's how to find it. First establish if it is there. Type spaces on top of the line number, or delete it, or copy the line without the number and execute it as a direct instruction from the keyboard. It will either give the same message or it won't. Suppose it does. Then the problem is in that line. Simplify the line and retry. If it's an IF line, replace everything after THEN with PRINT "YES"; if it still fails then your problems are before THEN. If you have a complicated expression, erase everything else and put PRINT in front of it. If it still fails unpack it. Keep PRINTing the bits. Frequently it is a READ statement that fails. Look at the DATA that goes with that READ. Check for dots that become commas or vice versa (in PRINT statements check for semicolons that become colons). If the READ is in a loop check the current value of the loop variable. If it is on the first time round, do you have extra DATA before that DATA of the loop? If the last, do you have missing DATA before DATA of the loop?

What to do if the line it fails on ISN'T wrong. That line was written for a purpose and under some circumstances presumably the computer ought to be executing it. Use lesson 2 below to analyse the program to find whether this is one of the times it ought to be executing it. If it isn't you know that it got there at the wrong time and you now know where it ought to have been. Look for the connection. If it ought to have been executing it and it was executing it and it still didn't work, and if it is not wrong, some other part of the program has fed it incorrect data. What are the values of the variables it was working on? (If you need a repeatable way of testing programs that use random numbers, see your manual on how to set the seed for randomizing).

PRIVATE EYE: LESSON 2

How to find a point of failure. Soon your program will stop falling over. (If it loops, BREAK into it, the loop is your point of failure). Now you have more subtle problems associated with "What I was trying to do was...". If it always goes wrong just after you've typed in FRED, hit BREAK just after you've typed in FRED. This gives you a guide to the relevant part of the program. Find out your program structure. With a soft pencil draw fine lines across the page under unconditional GOTOs and heavy ones under RETURNs. Draw braces beside each FOR...NEXT loop. Draw little arrows showing where GOTOs go to, and underline GOSUBs. Where does the line numbering skip to the next multiple of 1? How does it get to the various subroutines? Is there an ON...GOTO for the options of the main menu? What is kept in the biggest array(s)? (Try looking at what puts information in them.) If you understand the structure and roughly where it is going wrong, you have an area of failure. Put extra PRINT statements in the program to identify (a) where it went and (b) what values the variables had. If it shouldn't have been doing the line that it failed in, these print statements will locate the unwanted jump. If some message is wrong, find the PRINT statement that prints it.

PRIVATE EYE: LESSON 3

The magic method. Soon your program will only go wrong some of the time. Now ask the magic question "What (exactly) is the difference between the time(s) that it worked and the time(s) that it didn't? What did I do differently?" Check it, then check which piece of the program could possibly care if you did that.

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A similar tactic, if the program fails in the middle of a set of (nearly) identical lines, is to ask what is different about the one that failed.

INTERPOL: LESSON 4

Interpol are good at finding suspects given general evidence of a crime. They interrogate everybody (proofreading), and they look at those who are different. Is the fact that this line number isn't a multiple of 10 evidence that it was a late corection (bugs live in clusters)? The longest line in the program is the one most likely to be wrong. Count the items in each DATA statement – why does one differ? It may be legal on the Spectrum to jump to a line that doesn'r exist but it is probably wrong all the same. Suspect unround constants – x/2256 is probably a misprint for x/256. Why does it GOSUB 1300 here when there are lots of GOSUB 1300's? A variable O is probably meant to be Ø. If a variable name only occurs ONCE in the listing of a program it must be a bug.

INTERPOL: LESSON 5

Motive Opportunity Means. If the word SCISSORS appears in a printed message, it must have been produced by a PRINT statement with that in its text, or come from a DATA statement SCISSORS. Which lines had the means to create the hashup I can see? If the loudspeaker howls, which lines look after program sounds that had the opportunity? Which of those lines CAN call the sound routine under any circumstances?

INTERPOL: LESSON 6

When a murder is committed Interpol interrogate the last person to see the victim alive and the first person to see him dead. So, what was the FIRST thing your program did wrong when you ran it? What was the LAST thing your program did before it collapsed? Where did it go wrong?

MILITARY METHODS: LESSON 7

If you have tied the error to a smallish part of the program but just CAN'T see it, pretend to be a computer and carry out each Basic line. This is called hand-tracing. For an assembler program, buy a monitor and 'single-step' through the doubtful area.

MILITARY METHODS: LESSON 8

Try deleting the doubtful bit of program altogether. This can result in the program working, failing the same way (in which case the bit you deleted was innocent), or telling you what is wrong. Reinstate the deleted bit gradually to find where it is wrong, if it is.

MILITARY METHODS: LESSON 9

Delete the doubtful bit as in Lesson 8 and write your own version. You may suddenly understand. Alternatively your new version may work. Alternatively the bug may not go away. Whatever happens you learn something. **General Information:** The longer programs in INPUT have more bugs in them. (Time taken to write a program is proportional to the square of the number of lines in it. So is debugging effort.)

The text compressor, the assemblers and the Hobbies File databases are clean. The Input Hi-res (Commodore) and 'Escape' are least so. Apart from the Hobbies File, most programs in INPUT presented for four machines are four versions of the same program. Try comparing the version for your machine with the versions for the other machines. This often explains obscure methods as well as revealing misprints.

Beginners must: Read the manual that came with the machine. The Commodore inverse-print graphics are in Chapter 5, p.57 and Chapter 4, p.43. The Spectrum manual has how to type keywords in the Appendix. AT AND OR and TO are all keywords, and must be done this way. The BBC-B does not regard upper and lower case as indistinguishable. The Dragon and the BBC, unlike the C-64, may require a space between words if it could be ambiguous. The Plus/4 is NOT a C-64.

Tips to save your strength for debugging and avoid frustration in other directions: When typing in a long program, SAVE once an hour onto tape or disk. VERIFY the last SAVE of each session (BBC-B equivalent is *CAT). Do not SAVE the latest version on top of the last version you SAVEd in case the SAVE itself goes wrong. The BBC is most intolerant of wrong level on the tape recorder, the Dragon of wrong positioning along the tape (you are allowed about 1/10 second of latitude).

Switch the computer off before you unplug peripherals (especially cartridges). About 80 per cent of all Commodore repairs are for people who didn't! Do not type all your accounts into a program until you know it works and will save and reload data reliably. Do not attempt to RUN a program (especially one that POKEs itself or uses maching code) after typing it in before you have SAVEd it. If it goes wrong you may lose the lot. Save assembler source before you try to assemble it.

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Spectrum

Volume 1

Page 12, col. 2, Line 150, add □ between " "

Page 69, col. 3, delete text: Remember to delete it later.

Page 134, col. 3, Line 30, change PAUSE Ø to PAUSE 15

Page 139, col. 2, Line 25ØØ, change LEN to (LEN N$<3)-LEN

3, Line 2520, change LEN to (LEN N$<3)-LEN

Page 201, col. 3, Line 1Ø, change 6 to 7

Page 347, cols. 2 and 3, in Lines 61Ø, 63Ø and 3Ø1Ø IN must be typed; the abbreviated form [I] must not be used.

Page 356, col. 2, Line 5Ø, change <> to ><

Page 380, col. 2, Line 5130, line two, change "add', to "add",

Page 381, col. 3, Line 5350, after GOTO add 9999

Page 382, col. 1, Line 5490, change 542Ø to 532Ø

Page 408, col. 1, Lines 210, 280, change all ˆ symbols to ↑

Volume 2

Page 436, col. 1, Line 70, change 1Ø,21 to 1Ø,Ø21

Page 616, col. 1, delete last sentence under Spectrum editorial

Page 815, col. 3, Line 170, second line, after third symbol add "

Volume 3

Page 940, col. 3, Line 690, add ; after LET b=Ø

Page 984, col. 2, add Line 155 LET h=1

Page 1028, col. 2, Line 130, change "DD" to "CD"

Line 150, add ; after 12 and before NEXT i

Line 160, first line add : after 12 and, second line add : before NEXT i

Line 170, first line, add : after 12 change C$= to C$ add : before NEXT i

col. 3, Line 930, change i,j," " to i,j;"■"

Line 1030, after PRJNT change A to AT

Page 1029, col. 1, Line 1090 reverse P and O should be in graphics mode

Page 1057, col. 1 last group, print should be on separate line at foot

Page 1064, col. 2, Line 1850, change to to TO

Add Line 1930 IF KB=Ø THEN LET X2=7: PRINT#P

Delete Line 1940

Page 1074, col. 1, Line 200, change 2, to 2;

col. 3, Line 660, last line should read GOSUB 56Ø:GOSUB 76Ø: GOTO380

Line 750, change 18Ø to 18,Ø

Line 760, change 16,1) to 16,l;

Page 1075, col. 3, Line 390, change 16,1; to 16,l;

Line 400, last line, change IN7 to INK7

Line 430, add : after 54Ø fourth line, ad : after 6ØØ

Page 1076, col. 1, Line 460, delete one black square

Line 780, delete one white square

Page 1082, col. 1, Line 20, change 85 to 88

col. 2, Line 190, change x>-32768+sp to x<32768+88

Line 200, change x<32768-sp to x>-32768+SP

Line 210, change y>-224ØØ+sp to y<224ØØ-SP

Line 220, change y<224ØØ-sp to y>-224ØØ+SP

Volume 4

Page 1402, col. 2, change call scr to scn

Page 1486, col. 1, Line 530, delete LINE

Line 540 should be 54Ø IF I$=U$ AND TT=1 THEN LET TT=Ø: THEN GOSUB 3Ø4Ø:GOTO 27Ø

Line 640 should be 64Ø LET I=1

Page 1488, col. 1, Line 4510, change Y$+ to Y$=

Line 5000, delete INSTR ROUTINE

Lines 5010, 5020, 5030, 5040 delete and substitute: 5Ø1Ø LET IN=Ø:IF LENY$<=LENX$ THEN RETURN 5Ø2Ø LET Z=(LENX$-LENY$+1) 5Ø3Ø IF Y$= " " THEN LEN IN=Z: LET Z=(LENX$-LENY$-1)

Page 1493, col. 1, Line 2830, delete LINE

col. 2, Line 2930, delete LINE

col. 3, Line 3080, delete LINE

Page 1494, col. 3, Line 3240, delete LINE

Commodore

Volume 1

Page 48, col. 2, Line 70. The symbols are produced by the Shift and Asterisk keys

Page 49, col. 2, Line 1210, the symbols are produced by Cursor/Left keys

Page 114, col. 2, Line 30, change ; to :

Page 128, col. 1, Line 20, change 4,4: to 4,4,7:

Page 143, col. 1, Line 400 should be 4ØØ VV=INT(VAL(VV$)*1ØØ+.5)/1ØØ: VV$=STR$(VV):IFVV=INT(VV) THENVV$=VV$+".ØØ"

Page 196, col. 1, Line 1015, change LE to LE □

Volume 2

Page 429, col. 1, Line 10, delete 3 from end of line

Volume 3

Page 856, col. 2, Line 100, delete B=F at end and add 9Ø

Page 968, col. 1, change LDY#$18 to LDY#$1C

Page 994, col. 1, Line 1160, add ,Ø at end

Page 1019, col. 3, Line 1280, add : after 6)

Page 1031, col. 1, Line 235, change 1Ø" at end to 2Ø"

Page 1066, col. 1, add Line 1755 CD(2)=CD(2)-35

col. 2, Line 2170, before reverse R add reverse heart

Page 1077, col. 3, in text, change 5205, 6025 and 7025 to 52ØØ, 6Ø2Ø and 7Ø2Ø

Page 1098, col. 2, under SPEEDING UP THE PROGRAM, add "Commodore owners should POKE 44,12 before LOADING this program if they intend to RUN it."

Page 1157, col. 1, Line 2500, after DIM add R

Page 1174, col. 2, the C64 symbol should be blue, not black

Acorn

Volume 1

Page 52, col. 3, Line 4, delete + and insert &

Page 125, col. 3, the top paragraph is for the BBC only, not Dragon/Tandy

Volume 2

Page 487, col. 3, Line 940, delete the four ↑ and insert four ˆ

Page 633, col. 2, Line 20. When using the coder/decoder program from parts 20 to 22 to produce the DECODE file for Escape, it is important to change the following two lines: Line 20 should be 20 HIMEM=&79ØØ

Page 653, col. 2, Line 1900 should be 19ØØ *SAVE DECODE 79ØØ 7A8Ø

In addition the coding section from Part 20 *must* be typed in. Users of Basic I must add the following line to the game program from Parts 44 to 48 5000 DEFFNINSTR(A$,B$):IFLENA$ LENB$:=Ø ELSE:=INSTR(A$,B$) and change INSTR in Lines 550,660, 1990 and 3320 to FNINSTR

Volume 3

Page 910, col. 2, Line 920 should be 92Ø DATA 165,12Ø,8

Page 1124, col. 1, Line 120, change 144 to 145

col. 3, Line 540, change TAB to f5

Dragon/Tandy

Volume 1

Page 125, col. 3, the top paragraph is for the BBC not the Dragon/Tandy

Page 215, artwork, 46Ø8 should be 46ØB

Page 355, col. 2, editorial. Delete' Note, on the Tandy you'll have to change the 329 to 282 in Lines 20 and 999'; insert 'Note: Tandy TRS-80 users should delete POKE 329,Ø: from Lines 9Ø and 999.'

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